Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A system for determining the three dimensional shape of an object, comprising:

a first measuring ~~means~~ device for measuring a first distance and direction from a fixed first observation point to a first group of measurement points on the object, thereby obtaining first measurement results;

a second measuring ~~means~~ device for measuring a second distance and direction from a movable second observation point to a second group of measurement points on the object, thereby obtaining second measurement results, wherein at least one point among said second group of measurement points is a common measurement point, the common measurement point being the same measurement point as at least one point among the ~~aforementioned~~ first group of measurement points, ~~and~~ said second group of measurement points including at least one measurement point not included in the first group of measurement points [[,]] ;

a ~~calculating means~~ computer for:

(i) calculating ~~the~~ a traveling velocity vector of the second observation point from the measurement results concerning the ~~aforementioned same~~ common measurement point ~~due to~~ made by the first and second measuring ~~means~~ devices,

(ii) correcting the ~~aforementioned~~ second measurement results based upon said traveling velocity vector, and

(iii) calculating the three dimensional coordinates of the measurement points of the first group and the second group of measurement points [[,]] ; and

a ~~displaying means~~ display that displays an image of the object based upon the ~~aforementioned~~ three dimensional coordinates.

2. (Currently amended) A system as described in claim 1, characterized in that the second measuring ~~means~~ device is provided with a scanner unit comprising a laser radar

unit for ranging each point, a four-faceted polygon mirror for performing horizontal scanning, and a planar swing mirror for performing vertical scanning.

3. (Currently amended) A system as described in claim 2, characterized in that the second measuring ~~means~~ device is provided with a controller unit which internally houses a radar unit control portion, control portions for two mirrors, and an interface portion for sending measurement results to a measuring computer.

4. (Currently amended) A system as described in claim 3, characterized in that the second measuring ~~means~~ device is provided with a computer ~~provided with~~ having a recording medium ~~and which~~ that can store measurement results on said recording medium [[,]] and that can control the ~~aforementioned~~ a scanner unit and controller unit.

5. (Currently amended) A system as described in claim 1, wherein the traveling velocity vector ~~for which the three dimensional coordinate error is minimized~~ is determined by the conjugate gradient method, with the assumption that the traveling velocity vector ~~of the aforementioned second observation point~~ is time-independent, using the measurement results concerning the ~~aforementioned same~~ common measurement point ~~due to the first and second measuring means~~, and wherein the measurement result from the second observation point is corrected using said traveling velocity vector.

6. (Currently amended) A system as described in claim 5, characterized in that the translational motion vector that minimizes the following equation is determined by the conjugate gradient method:

[Equation 1]

$$E(\mathbf{p}) = \frac{1}{N(M-1)} \sum_{i}^{N} \sum_{j}^{M} \rho(z_{ij}(\mathbf{p}))$$

where

$$\mathbf{p} = (\mathbf{m}, \mathbf{q})$$

$$z_{ij}(\mathbf{p}) = \left\| \mathbf{R}(\mathbf{q})g(v)_i + m - \mathbf{y}_{ij} \right\|^2$$

$$\rho(z_{ij}(\mathbf{p})) = \log(1 + \frac{1}{2} z_{ij}(\mathbf{p})^2)$$

N: number of points of measured data

M: number of measured data

$E(\mathbf{p})$ is an error function defined as the weighted average of the $\rho(z_{ij}(p))$'s using the M estimation method with a Lorentzian function.

$z_{ij}(\mathbf{p}) = |\mathbf{R}(\mathbf{q})\, g(v)_i + m - y_{ij}|^2$ is the distance between corresponding points in the measurement results of the first and the second measuring ~~means~~ device.

m is the translational motion vector.

y_{ij} is the corresponding point in the jth measured image.

p is a parameter group comprising the translational motion vector **m** and a quaternion **q** that represents rotation.

R(**q**) is a function of the quaternion q that represents rotation.

g(v)i is a parameter for shape distortion due to uniform velocity motion.

7. (Currently amended) A system as described in claim 6, characterized in that a measurement point from the second group of measuring points that is not included in the first group of measurement points is corrected by using m', where m' is the $\mathbf{R}(\mathbf{q})\, g(v)_i$ + m that minimizes $z_{ij}(\mathbf{p})$.

8. (Currently amended) A system as described in claim 5, wherein the traveling velocity vector includes a rotational component and a horizontal motion component.

9. (Currently amended) A method for determining the three dimensional shape of an object, comprising:

measuring a first distance and direction from a fixed first observation point to a first group of measurement points on the object, thereby obtaining first measurement results;

measuring a second distance and direction from a movable second observation point to a second group of ~~observation~~ measurement points on the object, thereby obtaining second measurement results, wherein at least one point among said second group of measurement points is a common measurement point, the common measurement point being the same measurement point as at least one point among the first group of measurement points, ~~and~~ wherein said second group of measurement points ~~including~~ includes at least one measurement point not included in the first group of measurement points [[,]] ;

calculating ~~the~~ a traveling velocity vector of the second observation point from the measurement results concerning the ~~aforementioned same~~ common measurement point ~~due to the first and second measuring means~~ [[,]] ; and

calculating the three dimensional ~~coordinate~~ coordinates of said first group and second group of ~~observation~~ measurement points [[,]] by correcting the ~~aforementioned~~ second measurement ~~result~~ results based upon said traveling velocity vector.

10. (Previously presented) A method as described in claim 9, where the step of measuring a second distance and direction is carried out with a scanner unit comprising a laser radar unit for performing ranging of each point, a four-faceted polygon mirror for performing horizontal scanning, and a planar swing mirror for performing vertical scanning.

11. (Previously presented) A method as described in claim 9, where the step of measuring a second distance and direction includes sending measurement results to a measurement computer provided with a recording medium, through an interface.

12. (Currently amended) A method as described in claim [[11]] 9, where the step of measuring a second distance and direction includes saving measurement results to a recording medium with a computer.

13. (Currently amended) A method as described in claim 9, wherein the traveling velocity vector ~~for which the three dimensional coordinate error is minimized~~ is determined by the conjugate gradient method, with the assumption that the traveling velocity vector ~~of the aforementioned second observation point~~ is time-independent, using the measurement results concerning the ~~aforementioned same~~ common measurement point ~~due to the first and second measuring means~~, and wherein the second measurement results ~~result from the second observation point is~~ are corrected using said velocity vector.

14. (Currently amended) A method as described in claim 13, characterized in that the translational motion vector that minimizes the following equation is determined by the conjugate gradient method:

[Equation 2]

$$E(\mathbf{p}) = \frac{1}{N(M-1)}\sum_{i}^{N}\sum_{j}^{M}\rho(z_{ij}(\mathbf{p}))$$

where

$$\mathbf{p} = (\mathbf{m}, \mathbf{q})$$

$$z_{ij}(\mathbf{p}) = \left\| \mathbf{R}(\mathbf{q})\mathrm{g}(\mathrm{v})\mathrm{i}{+}\mathrm{m} - \mathbf{y}_{ij} \right\|^2$$

$$\rho(z_{ij}(\mathbf{p})) = \log(1 + \frac{1}{2} z_{ij}i(\mathbf{p})^2)$$

N: number of points of measured data

M: number of measured data

$E(\mathbf{p})$ is an error function defined as the weighted average of the $\rho(z_{ij}(\mathrm{p}))$'s using the M estimation method with a Lorentzian function.

$z_{ij}(\mathbf{p}) = |\mathbf{R}(\mathbf{q})\, g(v)_i + m - y_{ij}|^2$

is the distance between corresponding points in the measurement results of the first and the second measuring ~~means~~ device.

m is the translational motion vector.

y_{ij} is the corresponding point in the *j*th measured image.

p is a parameter group comprising the translational motion vector **m** and a quaternion **q** that represents rotation.

R(**q**) is a function of the quaternion q that represents rotation.

g(v)i is a parameter for shape distortion due to uniform velocity motion.

15. (Currently amended) A method as described in claim 14, characterized in that a measurement point from the second group of measurement points that is not included in the first group of measurement points is corrected by using m', where m' is the $\mathbf{R}(\mathbf{q})\, g(v)_i + m$ that minimizes $z_{ij}(\mathbf{p})$.

16. (Currently amended) A method as described in claim 13, wherein the traveling velocity vector includes a rotational component and a horizontal motion component.

17. (Previously presented) A method as described in claim 10, wherein the step of measuring a second distance and direction includes controlling the scanner unit and control unit with a computer.